



# Newsletter

Volume 17, Number 4  
July - August 2000

## Director's Note

For many ecologists in the Northern Hemisphere, May through September is "field season". The natural world takes advantage of warmer, longer days and there is much to be measured. Seeds are sprouting, established plants are growing, and animals are at the peak of their activity. Soil, rock, pond and river environments are reflecting warm weather changes as well.

The places where field research is done can be sizeable, and collecting data along all the transects, in plots and in watersheds, may take weeks of hiking, wading or swimming. IES has field sites not only at the Mary Flagler Cary Arboretum but also in the Hudson River, in the Catskill and Adirondack Mountains, in the forests of Connecticut, at the Hubbard Brook Experimental Forest in New Hampshire – which is where I do much of my research – and elsewhere around the globe.

Each field season, visiting students and scientists join our staff, some as summer project assistants, others as cooperating senior researchers, to help collect and use data to further our knowledge of ecosystems. This summer our staff has increased by a third, from 153 employees to 200. You'll find a sampling of the resulting "summer science" at IES in this issue of the newsletter.

The *IES Newsletter* is published by the Institute of Ecosystem Studies, located at the Mary Flagler Cary Arboretum in Millbrook, New York.

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## South African Savannas Spark International Collaboration

With Zimbabwe to the North and Mozambique to the East, South Africa's Kruger National Park is one of the largest national parks in the world. Kruger, roughly the size of Connecticut only longer and narrower, is at the southern end of Africa's Rift Valley, and its flat to rolling savannas support over 1,000 kinds of plants and a wealth of wildlife. It is therefore a popular destination for tourists and scientists from around the world. A leading center of wildlife research, the park has a rich scientific database that enhances its value as an ecological study site. In January 2000, Institute of Ecosystem Studies ecologists Steward Pickett and Mary Cadenasso began a new collaborative study there.

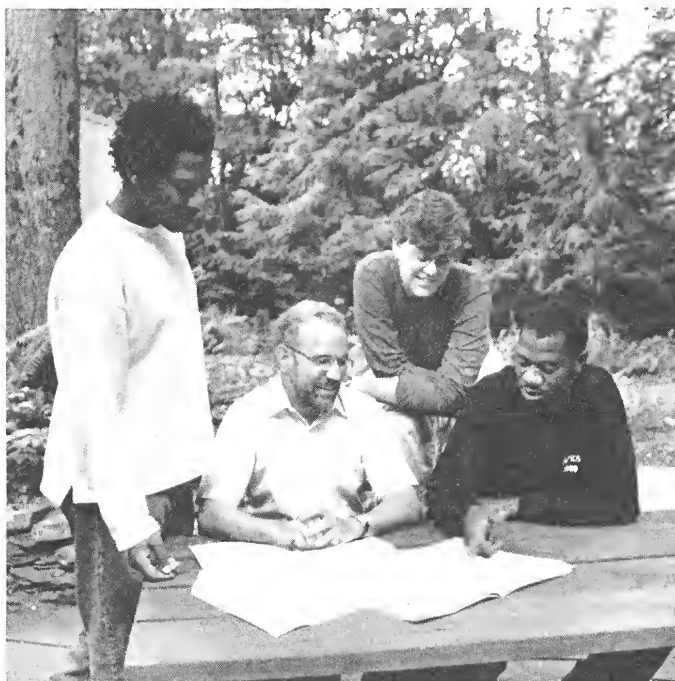
Savannas are grasslands with a scattering of trees. In the upland savannas of South Africa, these expanses of grasslands are broken by rivers, six in all through Kruger National Park. With a long interest in the role that boundaries, or edges, play in the landscape, Drs. Pickett and Cadenasso are collaborating with an international team of scientists\* to learn more about the role of riparian corridors — the rivers and associated riverbank ecosystems — in the savanna landscape. The program is funded by The Andrew W. Mellon Foundation, and over the next four years the collaborators will address three main objectives.

In Kruger's upland savannas, riparian corridors are the most obvious boundaries in the landscape and are recognized as "hotspots" of activity. The first objective of

the new collaborative study is to learn how forested areas along riverbanks affect the exchange of animals, plants and nutrients from savanna to river and back. Using remote sensing, including aerial photography and satellite imagery, the scientists will identify the types of riparian corridors, their distribution and their configuration; these remote images, captured over time, also will provide data on long-term dynamics among rivers, boundaries and savanna. The scientists will study processes of sediment deposition and removal, and the interactions between sediment and vegetation. They will look at the effects of floods on plant community structure, and at the vegetation in and along those rivers that seasonally dry up. Since changes in vegetation at and across the riparian-savanna boundary is one of the most important features of the boundary, they will do experiments to test the role of water, nutrients and seed availability on tree recruitment.

The second objective is educational. By actively drawing South African students in to research on ecosystem processes in their nation, the scientists aim to diversify future generations of South African as well as American ecologists. In a recent presentation to the Institute's summer project assistants and Research Experiences for Undergraduates program students (see page 5), Dr. Pickett elaborated on this goal. Not only do there need to be more ecologists in South Africa to manage and maintain its natural riches, he said, but also there is a need for diversity in the scientific community as a

*continued on page 4*



Left to right: Mr. Lesego Khomo, Dr. Steward Pickett, Dr. Mary Cadenasso and Mr. Ayanda Matoti, at IES.

\* Principal investigators on this study are: Prof. Tracy Benning, Univ. of California, Berkeley; Dr. Harry C. Biggs, Kruger National Park; Prof. Robert J. Naiman, Univ. of Washington, Seattle; Dr. Steward T.A. Pickett, IES; and Prof. Kevin H. Rogers, Univ. of the Witwatersrand, Johannesburg, South Africa.

LOANNA KELLY

# Chasin' the Lyme

It's becoming a summer tradition at IES for research assistants, students and summer project assistants to pool their talents for an informal evening of entertainment. At this year's talent show, one of the many stellar acts was a performance by the "Ostfeld Lab". Dressed in the white coveralls that are the uniform of their field work, the group belted out "Chasin' the Lyme" (see box). The chorus line stretched across the pavilion at the IES Recreation Field, reflecting the size of the crew spending this summer working on six different research projects dealing with the ecology of Lyme disease.

The leader of this group of 17 — which in addition to project assistants hired for a summer and fall of field work includes a year-round research assistant, two Research Experiences for Undergraduates students, a forestry student, a veterinary student, a medical student, two post-doctoral associates, and two visiting scientists — is Dr. Richard Ostfeld. The work of the Ostfeld laboratory this summer includes continued monitoring of acorns, white-footed mice, black-legged ticks and the Lyme disease bacterium on nine IES research plots, as well as a number of new projects that have evolved from discoveries made over the past several years in the Institute's on-going studies of Lyme disease ecology.

## A Search for Tick-borne Diseases

One of these projects deals with the broader subject of tick-borne diseases. The black-legged tick (formerly called the deer tick) is known to host not only the Lyme disease bacterium but also the bacterium that causes



Michele Sims dragging for ticks.

human granulocytic ehrlichiosis and the protozoan responsible for human babesiosis. The dog tick is known to host the bacterium that causes Rocky Mountain spotted fever. Dog ticks also carry the agents for the other three diseases, but are not as "efficient" a vector as is the black-legged tick; in other words, they are not as likely to transmit the bacterium through their bite. How prevalent are the disease agents in the two tick species? Do black-legged ticks have the potential to transmit Rocky Mountain spotted fever? Through the field work they are doing this summer, and the laboratory work they will

do during the fall, Ms. Michele Sims and Mr. Paul Rosenau are hoping to answer these questions.

Ms. Sims is a student at Tufts University School of Veterinary Medicine. She is interested in the new field of conservation medicine, and especially in zoonotic diseases (animal diseases that can be transmitted to humans) and wildlife rehabilitation. Mr. Rosenau is a student at Harvard Medical School. He too wants to go into conservation medicine and plans to specialize in epidemiology. Each student applied for research funding from the Center for Conservation Medicine\* to do a project at IES this summer in collaboration with Dr. Ostfeld.

*continued next page*

\* The Center for Conservation Medicine (CCM) is a newly established environmental health collaborative between Tufts University School of Veterinary Medicine, the Wildlife Preservation Trust International (WPTI) and Harvard Medical School's Center for Health and the Global Environment. Conservation medicine is an emerging discipline that links human and animal health with ecosystem health and global environmental changes.

## Chasin' the Lyme

by Kathleen LoGiudice, Michele Sims and Eric Schaubert\*, with consult from the Ostfelders

(Sung to the tune of "Stayin' Alive", by the BeeGees)

Well, you can tell by the way we wear white suits,

And the duct tape residue on our boots:  
We're the Ostfeld Lab, we're up at dawn,  
Just a-trappin' and a draggin' all day long.

Well it's alright, it's OK!  
You can study worms and clay,  
But we will try to understand  
How mice and ticks connect with man.

*Chorus:*

*Sourcin' and a-sinkin', it's diseases that we're thinking,*

*Chasin' the Lyme, chasin' the Lyme.*

*Mousin' and a-mastin' and risk forcastin',*

*Chasin' the Lyme, chasin' the Lyme.*

Well, you can tell by the way we crush our ticks,

We're serious, this ain't for kicks.  
We crush and grind and then — success!  
Those spirochetes, well they fluoresce.

Well it's alright, it's OK!  
You can stare at screens all day,  
But we will try to understand  
How mice and ticks connect with man.

*(Chorus)*

Well, you can tell by the way we set our nets,  
We can catch those birds with no regrets.  
We dig and trench for the pit-fall traps,  
We're catching shrews, we ain't takin' naps.

Well it's alright, it's OK!  
You can acid wash for pay,  
But we will try to understand  
How mice and ticks connect with man.

*(Chorus)*

\* LoGiudice and Schaubert are IES postdoctoral associates. Sims is profiled above.

**Editor's note:** The first part of the last verse of "Chasin' the Lyme" refers to two other Lyme disease ecology studies being done this summer: a determination of tick burdens and reservoir competence of ground-nesting birds; and determination of total vertebrate diversity and tick burdens on forest plots at IES. Animals are caged at the Rearing Facility until engorged ticks fall off — a period of no more than three days — then released at point of capture.

Weather permitting, Sims and Rosenau spend their days "tick dragging". Their collecting apparatus could not be simpler: a square of white corduroy attached along one edge to a rod that has a line tied to each end. (Dr. Ostfeld said that the pair also invented "tick chaps", which he describes as resembling "corduroy bloomers covering thigh to ankle, and which are particularly useful for collecting adult dog ticks".) Walking slowly across transects in Dr. Ostfeld's forested research grids, and in the grassy areas preferred by dog ticks, they take turns towing the drag cloth. Ticks are extremely sensitive to heat, motion and carbon dioxide, and as the cloth moves past blades of grass or twigs where they patiently wait for a passing warm-blooded animal, they swiftly climb aboard. At this time of year, two stages of black-legged tick are active, the barely visible larvae and the not-much-larger nymphs. It is the latter that the scientists are interested in, since nymphs have already had one blood meal and therefore there is a greater likelihood that they have picked up one or more pathogens. In the case of the dog tick, the adult is the only stage the tick draggers have found. After covering a transect, they pause to pick the ticks off the cloth and store them in glass vials.

Sims and Rosenau will bring these vials back to the genetics laboratory at the Harvard University School of Public Health, where

they will screen for the four pathogens. The technique they will use, refining it for this analysis, is called polymerase chain reaction (PCR), in which a known DNA sequence is used to identify one which is unknown. (PCR also is used in forensic science for DNA fingerprinting, and has many other applications as well.) Their findings of prevalence and co-infection rates will be useful not only to determine relationships between agents of tick-borne disease, but also as baseline data for future research. Ultimately the group intends to use their findings to educate both health care professionals and the public about the risk of exposure to vector-borne diseases.



Paul Rosenau learned techniques of fluorescence microscopy to check for the presence of Lyme disease bacteria in ticks.

LORNA KELLY

## IES Summer Ecology Day Camp



*Martian Walk ... Human Pinball ... Annelid Tag ... Game of Paranoia ... Soil Jeopardy ...*

Ninety-six young ecologists, grades 2-7, played these games, met IES scientists, studied soil and the creatures that call it home, learned about land use, and explored the Institute's fields and forests during this summer's Ecology Day Camp.

*Left: Campers on the "Martian Walk", during which they record signs of human impact on the environment. The counselor here is Ms. Barbara Laird.*

*Right: A group of campers in Session 5 (grades 5-7) pose on the IES Sedge Meadow Trail boardwalk. This newest of the Institute's public trails winds through a sedge-hummock wetland behind the Gifford Tenant House.*



JILL GOODMAN

## Fall Plant Sale

Saturday, Sept. 9:

10 a.m. - 4 p.m.

Sunday, Sept. 10th:

11 a.m. to 4 p.m.

hosta • grasses  
ferns • alpines  
Japanese anemones  
Crocosmia  
... and more ...

Gifford House Visitor and  
Education Center  
Route 44A, Millbrook

Starting Labor Day weekend the plant list will be on the IES Website. Go to [www.ecostudies.org/welcome/ThisWeek.html](http://www.ecostudies.org/welcome/ThisWeek.html) and follow the links. Call 914-677-5365 for more information.

## South African Savannas, from page 1

whole. "Science works best," he emphasized, "when there's a variety of goals and perspectives among its practitioners."

### IES Hosts South African Scientists

Mr. Ayanda Matoti and Mr. Lesego Khomo are graduate students at the University of Witwatersrand in Johannesburg, working with Professor Kevin Rogers, project director of the Kruger National Park study. (Prof. Rogers took a sabbatical leave at IES in 1995, and his work was featured in a story in Vol. 12 No. 3 of the *IES Newsletter*.) They spent a month at the Institute earlier this summer, doing library research and sharing ideas with Drs. Pickett and Cadenasso to learn more about the science of landscape ecology. Now, back in South Africa, they are completing and presenting a formal research plan, based on their work here. After evaluation and approval of these proposals, they will begin their field work at Kruger, staying at a field station built specifically for the project.

Mr. Matoti is a doctoral student whose master's degree research on soil quality led him to his current focus on sodic soils. These soils have extremely high levels of sodium; visitors to Africa who have visited a salt lick to see the wide variety of animals who congregate there were probably unaware that they were gazing at a sodic patch. Matoti is investigating everything about sodic patches, how they got there, their chemistry, their relevance to landscape heterogeneity and their importance to biodiversity. Elaborating on the latter, he explains that animals gather at sodic patches not only for the salt but also so that they can keep an eye out for predators — since plants cannot grow large or dense in these soils, predators have nowhere to hide. To select his study sites, he will examine aerial photographs in which sodic soils show up as gray patches, some as large as 100 meters [over 300 feet] in diameter. Analyzing these photos may also aid him in explaining why they are where they are, since their formation may be a function of the way a river bends.

Mr. Khomo's master's degree research deals with the geomorphology of Kruger's upland savanna, and in his field work he will be linking vegetation to physical structure of the gradients from riparian sites to uplands. Geomorphology, often a key controller of vegetation composition and structure, is an interesting feature in the Kruger National Park because it changes based on different kinds of bedrock. In the northern areas of the park, channels run in seams or faults of dolerite that exist between blocks of granite. The trees are stunted on the granite compared to the channels in dolerite, where trees are taller. The channels form a drainage

network to the wider riparian zones to the south. Khomo will be doing transects of vegetation in this drainage network, integrating different size channels with different terrestrial frameworks. The research work of Pickett and Cadenasso will ultimately examine the ecosystem functions along the kinds of gradients that Khomo is quantifying.

### The Third Objective: Kruger Benefits

This project, a multi-faceted investigation of the role of riparian corridors in the savanna landscape, will result in a wealth of new scientific knowledge on the interrelationships between plants and animals and their habitat. While planning their research program, the collaborating scientists emphasized the importance of integrating this new knowledge into park management. Dr. Harry Biggs, a key staff scientist from Kruger, is one of the project's principal investigators and he

will ensure that the linkage with Kruger National Park science and management is tight.

At a media briefing at Kruger's Skukuza Camp in February, when the Mellon grant was announced, Kruger National Park Director David Mabunda explained how the research will benefit the park. "We are already in the early implementation phase of a full-scale, formally-specified process to join scientifically-determined results meaningfully into decision making and management, and create all the feedback loops that keep this system alive and functioning well," said Mr. Mabunda. "For any of you who have followed ecosystem management literature, you will know what a tall order this is in the real world. We hope this program brings us one important step closer to achieving a healthy functional science-management relationship right here in the corner of South Africa."

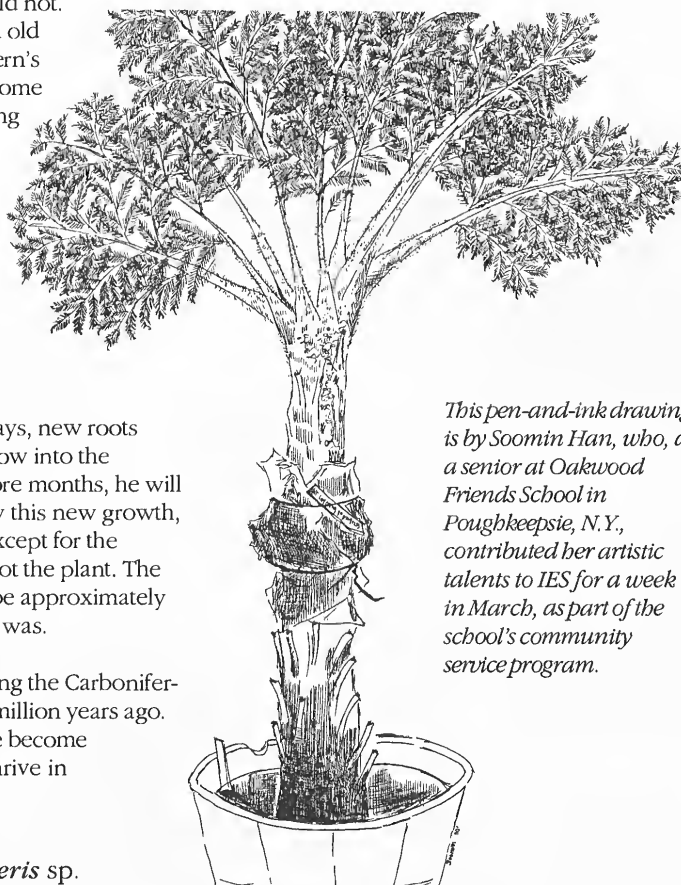
### Air Layering in Progress

Ten years ago, a spore from a tree fern in the IES Greenhouse landed in a nearby pot. Sometime later, Manager of the Greenhouse Complex David Bulkeley discovered the young plant and transplanted it. That tree fern is now some 15 feet tall.

This could have been a problem because the glass roof of the Greenhouse isn't much higher than 15 feet, but Bulkeley had a solution: a technique called "air layering", by which the plant is prompted to grow roots where it normally would not. Last summer, he peeled old fronds away from the fern's trunk-like stem, made some nicks and applied rooting hormone to these cuts. After surrounding the area with wet sphagnum moss, he wrapped it in plastic, leaving an opening at the top so the moss could be watered often.

After a year, Bulkeley says, new roots should be starting to grow into the sphagnum. In a few more months, he will cut the trunk just below this new growth, remove all the fronds except for the youngest ones, and repot the plant. The resulting tree fern will be approximately four feet shorter than it was.

Tree ferns evolved during the Carboniferous period, 345 to 280 million years ago. Many species have since become extinct but some still thrive in tropical regions.



*This pen-and-ink drawing is by Soomin Han, who, as a senior at Oakwood Friends School in Poughkeepsie, N.Y., contributed her artistic talents to IES for a week in March, as part of the school's community service program.*

*Sphaeropteris sp.*  
Australian tree fern

# Sharing Science

The value of doing good science is diminished if the scientist can't clearly communicate her or his results. "Sharing Science" is the Institute's way of helping its Research Experiences for Undergraduates (REU) students become more effective communicators. This summer's REU students worked with the Children's Media Project in Poughkeepsie to gain experience in communicating science.

IES has offered a Research Experiences for Undergraduates program (see box) since 1988. From June through August, undergraduate-level college and university students collaborate with a mentor — in most cases an IES scientist or visiting scientist — to design their own research project, do field studies and/or laboratory work, and analyze results. At the end of the summer they present their findings at a public symposium, then prepare reports that are published as an IES Occasional Publication. Over these past 13 years, the Institute has mentored 124 young scientists in its REU program.

The Institute's REU program aims to give students a head start in their scientific careers, so in addition to doing independent research the young scientists participate in a number of activities that help to broaden their experience. At the mid-summer "Forum on Opportunities in Ecology", REU participants, together with students from nearby colleges and universities, meet at the Institute with professionals whose science background has led to careers in environmental laboratories, academia, industry, government, law, museums, the media and more. REU students learn practical skills, such as planning a project, statistics, making slides for presentations and communicating research results, through weekly "Research Strategies" seminars, while the "Research-in-Context" series is designed to help students

put their own research into the broader perspective of the discipline of ecology. "Sharing Science" is part of the latter.

## One-on-One with the Talking Walls Program

One Thursday in mid-July, 12 high-school students participating in the Talking Walls Program of the not-for-profit Children's Media Project, located in Poughkeepsie, N.Y., spent the day at IES. The purpose of the Talking Walls Program, which is funded by the MacArthur Foundation, SONY and the Allyn Foundation, is to help teen-agers from the Poughkeepsie area learn what they're good at, what they want to become, and how to work together. To accomplish this, program director Ben Kalina and coordinator Tim Sutton encourage self-exploration and self-expression in group activities. While the principal focus of the program is media literacy and the making of documentary films, Kalina and Sutton also try to instill in the students the idea of community, an awareness of the environment, and connections within and between each. This is what brought them to IES: through the programs here, the students gained an understanding that ecosystems

work in a way that is not unlike social systems.

The visit began in the classroom at the IES Gifford House Visitor and Education Center with a presentation by Dr. Steward Pickett on his urban ecology research (Dr. Pickett is the principal investigator of the Baltimore Ecosystem Study) and — together with South African scientists Ayanda Matoi and Lesego Khomo — on the new project in Kruger National Park (see page 1). At this point the Institute's REU students took over. After explaining their research projects, they instructed their guests to tuck pants into socks and follow them outdoors. Along the IES education corridor they had set up research demonstrations at a groundwater well, at forest study plots, and at, and in, Wappinger Creek — donning hip boots, those who wanted to waded into the stream where their dip-nets came up with crayfish, caddis fly and black fly larvae, and a truly incredible planarian worm. At the end of the day, IES educator Joan Doyle led the Talking Walls Program participants in building a "concept map" on the blackboard, so they could visualize the ecosystem connections they had just learned about.



Is it loam, clay-loam or clay? At one of the forest study plots in the IES education corridor, REU students demonstrated the way to determine soil texture. L. to r., REU students Anita Pahuja and Candiss Williams with Talking Walls Program participants Natasha Thomas and Ryan Neil Sullivan, both students at Poughkeepsie High School.

## IES REU Program: Summer 2000

The National Science Foundation (NSF) developed the Research Experiences for Undergraduates program in the mid-1980s as a way to improve science education in the U.S. and to draw young people into science, mathematics and engineering. Many institutions across the country compete for NSF funds to support REU students, and consistently the Institute of Ecosystem Studies has been among the recipients. Since 1994, IES also has received REU funding from The Andrew W. Mellon Foundation.

The ten students participating in IES REU program this summer were:

- Brian Allan (University of Michigan—Ann Arbor, Mich.): *The effect of forest fragmentation on Lyme disease risk.* Mentors: Drs. Richard Ostfeld and Felicia Keesing

- Amy Burgin (Coe College, Iowa): *The influence of variable discharge on nitrogen uptake in a small mountain stream.* Mentors: Drs. Robert Stelzer, James McCutchan, and Gene Likens
- Olivia Ford (Florida Memorial College, Fla.): *Host choice of larval black-legged ticks for white-footed mice and eastern chipmunks.* Mentors: Drs. Richard Ostfeld and Felicia Keesing
- Carolyn Klockner (Hiram College, Ohio): *Behavioral interactions between a native and exotic species of crayfish: foraging effects on native bivalves.* Mentor: Dr. David Strayer
- Christina Knowlton (Pacific Lutheran University, Wash.): *Microbial respiration in response to varied concentrations of dissolved organic carbon in groundwater.* Mentor: Dr. Stuart Findlay

- Elvira Litson (Arizona State University, Ariz.): *Streambank erosion on the Wappinger Creek.* Mentors: Dr. Stuart Findlay and the Dutchess County Environmental Management Council
- Jessica McPherson (Earlham College, Ind.): *Influences of restricted tidal exchange volume on water characteristics in Hudson River marshes.* Mentor: Dr. Stuart Findlay
- Anita Pahuja (Brown University, R.I.): *Mycorrhizal infection across a pH and calcium gradient.* Mentor: Dr. Seth Bigelow
- Candiss Williams (Tuskegee University, Ala.): *Regulation of nitrification in an urban landscape.* Mentor: Dr. Peter Groffman
- Kara Yakubik (Florida Institute of Technology, Fla.): *The role of mosses in stream ecosystem functions.* Mentors: Drs. Robert Stelzer, James McCutchan, and Gene Likens



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### Calendar

#### CONTINUING EDUCATION

For fall 2000 program information, or to request a catalogue, call the Continuing Education office at 914-677-9643. Programs during September and October include\*:

##### *Gardening*

Sept. 16: **Putting Your Garden to Bed: Fall Maintenance Tips**

Sept. 23: **Gardening with Deer**

Sept. 23 (7 sessions): **Plants for the Landscape: Herbaceous Perennials - Extended**

Oct. 2 (6): **Soil Science**

Oct. 14: **Garden Questions and Answers**  
*Landscape Design*

Sept. 12 (4): **Construction II: Site Detailing**

Sept. 14 (5): **Ecological Landscape Design: Successful Design with Native Plants**

Sept. 20 (7): **Graphics I**

Oct. 7: **Rejuvenating the Home Landscape**

Oct. 12 (8): **Landscape Design I**

Oct. 28: **Contour Plans**

##### *Natural Science Illustration*

Sept. 11 (6): **Drawing I: The Basics**

Sept. 16: **Field Sketching**

Sept. 17 (4): **Seasonal Plants in Watercolor - Special Topics**

Sept. 23 (3): **Botanical Watercolor I: Techniques**

Oct. 19 (4): **Focus on Leaves**

Oct. 30 (6): **Drawing II: Illustration**

##### *Biology and Earth Science*

Sept. 14 (8): **Basic Botany**

Oct. 15: **Economic Botany**

Oct. 15: **Medicinal Plant Research**

##### *Workshops*

Sept. 22: **Practical Plant Propagation**

##### *Natural Crafts*

Oct. 7 (2): **Keepsake Pine Cone Wreath**

Oct. 14: **Herbal Holiday Gifts**

Oct. 21: **Drum Making**

##### *Ecological Excursions and Garden Tours*

Sept. 10: **Creative Gardens in Connecticut**

Sept. 23: **Sunrise Adventure, Constitution Marsh**

Sept. 25: **Contemplative Gardens**

Oct. 14: **Wave Hill and The New York Botanical Garden**

\*Visit the IES Website to see the complete course list for fall.

#### IES SEMINARS

Free scientific seminars are held each Friday from September until May, at 11 a.m. in the Auditorium.

Sept. 15: **Topic: The Ecology of New Zealand Forests.** Dr. David Coones, Manaaki Whenua Landcare Research, New Zealand

Sept. 22: **Recent Policy Developments for Ozone and Acid Rain.** Dr. Kate Joyce, SUNY Plattsburgh

Sept. 29: **Allocation Based Trade-offs and Seedling Regeneration Ecology of Tree Species.** Dr. Kaoru Kitajima, Univ. of Florida

Oct. 6: **Urbanization of the South Carolina Coastal Plain: Implications of Alternative Land Use Strategies to Salt Marsh Ecosystems.** Dr. Gary Kleppel, Univ. of Albany

Oct. 13: **The Phenomenon of Declining Growth in Older Forests: Experimental Tests.** Dr. Dan Binkley, Colorado State University

Oct. 20: **Topic: Environmental Policy in Europe.**

Dr. David Baldock, Institute for European Environmental Policy, London

Oct. 27: **Topic: Research in the Sierra Nevada Forests.** Dr. Ruth Ann Kern, California State University, Fresno

#### THE ECOLOGY SHOP

New in the Shop ... *Annuals with Style*, by Mike Ruggiero (IES Continuing Education Program instructor) and Tom Christopher ... photo T-shirts, (Perennial Garden flowers) ... niobium jewelry ... **for children** ... bluebird-box kits ... nature games ... **in the Plant Room** ... wind chimes ... ceramic planters  
**Senior Citizens Days:** 10% off on Wednesdays

#### HOURS

Summer hours: April 1 - September 30

Public attractions are open Mon. - Sat., 9 a.m.-6 p.m. & Sun. 1-6 p.m., with a free permit.

(Note: The Greenhouse closes at 3:30 p.m. daily.)

The Ecology Shop is open Mon.-Fri., 11 a.m.-5 p.m., Sat. 9 a.m.-5 p.m. & Sun. 1-5 p.m.

(The shop is closed weekdays from 1-1:30 p.m.)

Winter hours begin October 1

The grounds and Ecology Shop close at 4:00 p.m.

• Free permits are required for visitors and are available at The Ecology Shop or the Education Office before 5 p.m. daily (3 p.m. after Oct. 1).

#### GREENHOUSE

The greenhouse is a year-round tropical plant paradise and a site for controlled environmental research. The building is open until 3:30 p.m. with a free permit (see HOURS).

#### VOLUNTEER OPPORTUNITIES

Call Ms. Su Marcy at 914-677-7641

#### MEMBERSHIP

Join the Institute of Ecosystem Studies. Benefits include subscription to the newsletter, member's rate for courses and excursions, a 10% discount on IES Ecology Shop purchases, and participation in a reciprocal admissions program. Individual membership: \$30; family membership: \$40.

Call the IES Development Office at 914-677-5343.

##### **The Institute's Aldo Leopold Society**

In addition to receiving the benefits listed above, members of The Aldo Leopold Society are invited guests at spring and fall IES science updates. Call the IES Development Office at 914-677-5343.

#### TO CONTACT IES ...

... for research, graduate opportunities, library and administration:

Institute of Ecosystem Studies  
Box AB

Millbrook NY 12545-0129

Tel: 914-677-5343 • Fax: 914-677-5976

Street address: Plant Science Building,  
Sharon Turnpike (Rte. 44A), Millbrook, N.Y.

... for education, general information and The Ecology Shop:

Institute of Ecosystem Studies  
Education Program, Box R

Millbrook NY 12545-0178

Tel: 914-677-5359 • Fax: 914-677-6455

The Ecology Shop: 914-677-7649

Street address: Gifford House Visitor and Education Center, Sharon Turnpike (Rte. 44A), Millbrook, N.Y.

... IES Website: [www.ecostudies.org](http://www.ecostudies.org)

For information on current IES public events and attractions, visit: [www.ecostudies.org/welcome/ThisWeek.html](http://www.ecostudies.org/welcome/ThisWeek.html).

For garden tips, follow the link to the Perennial Garden Archives.